Habitat for Humanity Global Village: Means & Methods of Construction in Trinidad & Tobago

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Habitat for Humanity Global Village is a sector of Habitat for Humanity that focuses on aiding in the construction of homes for those in need around the world. Habitat for Humanity Trinidad and Tobago has been part of Habitat for Humanity Global Village for many years and aids people in need on the Island of Trinidad in the Southern Caribbean. This paper will discuss the construction of a small home for a woman whose family was disowned by her father due to her reluctance to uphold traditional Indian values. Subsequently the family was living in poverty and currently residing in a small car. With the help of a local contractor and local labor, a team of volunteers broke ground on a simple concrete and concrete masonry unit structure to house the family in need. This project will include a complete composition of the building practices and materials used throughout the construction process in Trinidad as well as a schedule and analysis of the project. Personal experiences, including means and methods of construction and firsthand building experience, encountered throughout the build will also be discussed.

Key Words: Habitat for Humanity, Schedule, Volunteer, Concrete, Caribbean

Introduction

Aside from small projects around my childhood home, volunteering for Habitat for Humanity jumpstarted my love for construction and helping those in need. For this reason, I chose to team up with Habitat for Humanity again. After researching Habitat for Humanity opportunities extensively I decided on a Habitat for Humanity Global Village project in outside of Port of Spain in the country of Trinidad and Tobago.

After months of fundraising and planning myself and fellow Construction Management student left for Trinidad in the latter half of October of 2018. After a couple of long flights, we landed in Port of Spain, Trinidad, by far the furthest I had ever been from the United States of America. For the duration of the project we stayed in a hotel in the neighboring town of Macoya along with the rest of our Habitat for Humanity build team. Our team consisted of 15 volunteers from a variety of backgrounds and with varying levels of construction experience ranging from owners of general contracting firms to inexperienced volunteers.

For the duration of our time in Trinidad our team worked in the Calcutta Settlement of Trinidad just south of Port of Spain. The project team was tasked with starting a new home for a woman whose family had been disowned by her father due to her reluctance to uphold traditional Indian values. She had had a child out of wedlock and had another child on the way with a local Trini man who also already had two children. Due to their circumstances they were living in poverty and residing in a small car.

Through our week of construction, the build team was tasked with completing the foundation and slab of the new home. The following will discuss some of the challenges encountered on this project as well as provide a complete construction schedule and analysis of the project.

Building Process and Materials

The proposed structure for our home build was a simple roughly 20’x40’ concrete masonry unit (CMU) home with two 20’x20’ rooms. The foundation was to be constructed by pouring concrete footings and 2 courses of CMU

risers, which acted as a retaining wall to contain the soil under a 20’x40’ slab. The structure was then to be completed with 10ft CMU block walls and a simple corrugated metal roof.

Concrete Foundation

The foundation excavation of the home was started by a small excavator prior to our arrival; however, the trenches were not dug to full depth or width needed to support the building. In order to complete the foundation, the team hand dug 3’x3’x3’ holes at the building corners and midpoint of the 40’ wall lengths. In addition, to connect the building corners and midspan, 20’ long trenches, 2’ wide and 2’ deep were dug, that spanned the lengths between the building corners and midspan (Figure 1).

Figure 1: Excavation Complete

To support the foundation, seven 20’ long, 1’ wide and 1’ tall, rebar cages and six 2’x2’x2’ rebar cages were built. These rebar cages specifically supported the building corners and midspans. These cages were constructed from typical #4 rebar which arrived on site in 20’ lengths (Figure 2). The rebar was bent by hand on site into the necessary cage sizes. To finish the rebar 4’6” dowels were tied into the cages to support the future CMU risers.

Figure 2: Rebar Cages

Upon placing the rebar cages into the trenches and corner holes the team began the process of filling the foundations with concrete to 1' below ground level. The concrete was hand mixed onsite, on top of a small asphalt patch at the corner of the build site (Figure 3). There was no specific mix design for the concrete however the team mixed roughly equal parts cement and sand aggregate to create our foundation concrete. The team then used a few small wheel barrels and a bucket brigade to pour our foundation concrete (Figure 4). On the second day of foundation pours the local contractor was able to acquire a small concrete mixer to expediate the process.

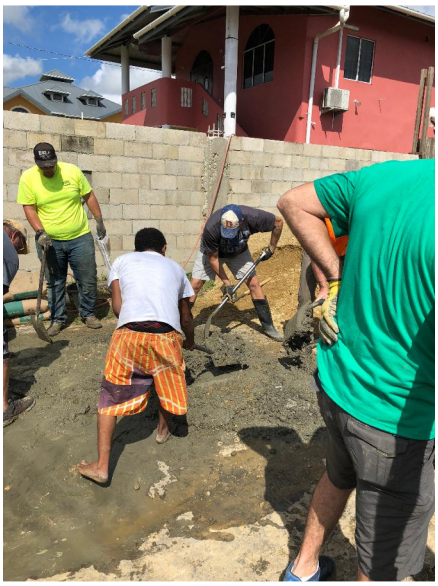

Figure 3: Hand Mixing Concrete

Figure 4: Foundation Concrete Pour

Concrete Masonry Unit Risers

The foundation of the structure was completed by adding two courses of typical 16"x6"x8" CMU's on top of the foundation concrete (Figure 5). To complete the CMU foundations, mortar was mixed at roughly a 1/5 cement to sand ratio and laid the blocks using string lines however there was no access to a level to level the blocks.

Figure 5: CMU Foundation Walls Complete

Slab Preparation

After completing the foundation, the team began to prepare for the slab pour. To compact the soil inside of the foundation the team stomped down the existing soil and used rudimentary tampers that were constructed from scrap wood onsite (Figure 6). There was no specific compaction percentage, the team just simply tried to compact as much soil as possible to reach the level of the two courses of CMU's. With the soil compacted to the level of the foundation the team proceeded to cover the slab area with a typical waterproofing membrane. This was then topped with a 6"x6" wire mesh to hold the slab together (Figure 7). The team then began to construct the necessary formwork to allow for a 6" slab pour, however were unable to finish the formwork by the deadline.

Figure 6: Tamper made from scrap wood

Figure 7: Waterproofing Membrane and Wire Mesh laid

This completed our groups construction effort on the project. Upon speaking with the contractor that was overseeing our build I determined that there would be a 6" slab pour followed by 10' CMU walls and a rudimentary corrugated metal roof to finish out the project.

Schedule

In the days leading up to our arrival in Trinidad and Tobago the country experienced some of the worst rain it had seen in the last 80 years, according to the locals. This flooding affected our build site. Upon arriving to the jobsite, we found that excavated trenches were full of mud and water and the whole build site was almost unwalkable due to the thickness of the mud. This greatly delayed our excavation of the foundation footings because the team had to hand bail the water and mud out of the trenches before beginning to dig further down. This cost us a total of a full day on the project.

Figure 8: Jobsite Condition Upon Arrival

I have attached an initial project schedule (Appendix A) and the actual project schedule (Appendix B) of our build. Appendix B also includes images of the project at the end of each day. As shown on the actual project schedule the team failed to complete the slab pour due to the impact of poor site conditions and dewatering on Day 1. Further delays to the initial schedule will be discussed in the Lessons Learned section of this paper.

Experiences in Construction

This project, because of its location and lack of access to modern construction equipment and tools, was a great opportunity to gain hands-on experience with building materials like those used in the United States but with a much more rudimentary building process. This provided the opportunity to work with common building materials while still performing the work all by hand with simple tools and processes. I was able to perform a multitude of tasks that in turn has allowed my knowledge of building to expand. From this experience I gained exposure to the following activities while on the site in Trinidad:

- Dewatering (without modern equipment)
- Excavating (without modern equipment)
- Layout (without modern survey/advanced tools)
- Rebar cage construction
- Rebar tying
- Hand mixing concrete (with appropriate ratios)
- Small scale concrete mixing (with onsite mixer)
- Pouring concrete (without modern equipment)
- Mixing mortar (with onsite mixer)
- Installing concrete masonry units
- Compacting soil (without modern equipment)
- Placing waterproofing membrane
- Building formwork

Lessons Learned

Due to the circumstances that we faced while building in Trinidad I have focused my lessons learned around the delays to our project. Our build was drastically impacted by weather. In addition to less than ideal site conditions this build was also affected by a lack of adequate communication and coordination.

Trinidad saw the worst rain the country had seen in almost a century just prior to our arrival. Although we were able to leave the airport within 2 hours of arriving in Trinidad many of our fellow volunteers were stuck in the airport for up to 8 hours because none of the local taxis were willing or able to drive through some 3 feet of water on the roads.

To put it in prospective, the only freeway through the country was completely shut down for 4 days and only half of it was open for the duration of our built. 1000's of local Trini's were forced from their homes due to flooding.

Due to this unfortunate event our project schedule was greatly affected. The home was scheduled to be completed by two Habitat for Humanity Global Village teams. It was our responsibility to complete the slab so that the next group could build out the walls and roof of the structure. As you can see from Appendix A and Appendix B, we lost a full day on an already accelerated schedule due to the multitude of rain prior to our arrival. My takeaway from this unfortunate event is that weather can have a drastic effect on a project no matter the size. Upon completing this project, I have a better understand of the effect of weather on any jobsite.

In addition to delays due to weather our project was also affect by communication and coordination, both onsite and in procurement. As previously mentioned, the trenches were originally dug with a small excavator prior to our arrival onsite, however, due to a lack of communication between the excavation team and Habitat for Humanity the trenches were only half as deep as they needed to be, thus delaying the foundation pour. As shown in the initial schedule (Appendix A). We were to pour foundation concrete on day two of the build with an onsite mixer, as shown on day 3 of Appendix B, however, again due to an error in coordination the mixer did not arrive onsite until the fourth day of the build. This caused us to hand mix concrete on day three of the build. My takeaway from this aspect of our build is that even a slight mistake in communication and coordination can greatly impact a project. With a build of only five days these errors contributed to a 16.67% increase in total time on the initial schedule of the project.

Applied Knowledge

While my lessons learned may have seemed critical of our build, I would like to state that I wouldn't have it any other way. If our build had gone smoothly, I would have learned much less than I did.

The impact of weather and coordination delays allowed me to gain valuable construction and life experience that I would not have gained from a cookie cutter project with no hiccups. With the lack of a strictly structured schedule and no official building plans our team mitigated all delays to the best of our ability and with this lack of structure, it was exceptionally easier to receive clarification and continue to build unlike the RFI process I have experienced on previous projects.

Although this project was unlike anything I anticipate experiencing in the commercial building industry upon graduation, I gained a multitude of knowledge that I can apply to any project in my future career in construction. I now have a better understanding of the effects of weather on a project. I see this helping me in the future when a jobsite is impacted by unexpected site conditions.

Furthermore, gained an enhanced appreciation for the importance of coordination on a jobsite and in procurement. I anticipate this helping me to keep projects on schedule in the future by mitigating coordination errors between subcontractors and material and equipment suppliers, as well as communication errors between building teams. Overall, although I don't anticipate completing anything like this build in the future, I know the knowledge I gained completing this project will help me for the rest of my career.

Reflection

This project provided a lot of new experiences for me. Prior to deciding to travel thousands of miles to complete this project with Habitat for Humanity Global Village I had never left the continent of North America. Just traveling to Trinidad and facing the flooding effecting the country was an experience for me. Once we were able to get to the jobsite and begin the build, I experienced a multitude of different building techniques that I had not been exposed to. Because we used similar materials to a typical construction project in the United States, I was able to experience what it would have been like to build in the United States without the equipment and technology we have today. I also gained a greater appreciation for what the trades in the field do daily.

I came into this build with a host of experience working with Habitat for Humanity however on a typical Habitat for Humanity job in the United States the build team changes every day. With Habitat for Humanity Global Village I got the opportunity to work with the same build team for the duration of the project. This allowed us to gain a sense of comradery and helped us work as a team through adversity in order to reach our goal. I also learned a lot about leadership from our team leader, Steve. Steve has led over 20 Habitat for Humanity Global Village builds and he told us this was the hardest project he had ever encountered, however, ever at over 60 years old he was the hardest worker on the jobsite. This showed me what it meant to lead by example and that is something I will remember for the rest of my life.

At the conclusion of our weeklong build we had the opportunity to sit down and have dinner with the family we were helping. Meeting and conversing with the woman who desperately needed our help made our hardships during the build seem insignificant. Overall, I am glad I chose to complete my senior project with Habitat for Humanity Global Village. I gained more than I ever thought I would from this experience and am excited to apply what I learned to my life and career in construction.

Conclusion

Through my experience with Habitat for Humanity this was the toughest build I have ever been a part of; however, it was also the most rewarding. Being able to meet the family and build on the same jobsite for the same week with the same build team was a great experience. I gained extensive knowledge of building materials and processes that I can apply to my construction career and learned lessons that will help me in my life and in construction. In completing this project, I have seen the effect of a variety of delays on a project and hope to be able to mitigate such delays better in the future. Unfortunately, in the end we faced a multitude of challenges and were not able to complete the slab of the home before our deadline, however, the family was still grateful that their new home had broken ground and I am grateful for the experiences I had while building their future home.

Appendix A Initial Construction Schedule				
Day 2 (October 23th, 2018)	**Day 3 (October 24th, 2018)**	**Day 4 (October 25th, 2018)**	**Day 5 (October 26th, 2018)**	
Excavation - Finish Excavation				
Rebar Cage Buildout - Built 7 20'x1'x1' Cages - Built 6 2'x3'x3' Corner Cages - Tie Dowels into Cages				
Place Rebar - Place Cages into Excavation - Prep Cages for Foundation Pour				
	Pouring Foundation - Mix Concrete - Pour Concrete			
		CMU Foundation - Mixed Mortar - Laid 2 Courses of CMU Blocks		
			Compaction - Excavated Excess Dirt - Compacted Dirt	
			Slab Preparation - Lay Waterproofing Membrane - Lay Wire Mesh - Set Formwork	
				Slab Pour - Mix Concrete - Pour Concrete

Appendix B
Actual Construction Schedule

Day 1 (October 22th, 2018)	Day 2 (October 23th, 2018)	Day 3 (October 24th, 2018)	Day 4 (October 25th, 2018)	Day 5 (October 26th, 2018)
Excavation - Partially Excavated Upon Arrival - Digging by Hand - Dewatering by Hand	**Excavation** - Dug Additional 1' Excavation in Trenches - Dug Additional 2' at Corners			
Rebar Cage Buildout - All Rebar Arrived on Site in 20' Sticks - Built 7 20'x 1' x1' Cages	**Rebar Cage Buildout** - Built 3'x 3'x 3' corner cages - Tied Dowels into Cages to Support CMU Blocks			
		Placing Rebar - Lowered Rebar Cages into Excavation - Leveled Rebar in Trenches for Pour		
		Pouring Foundation - Hand Mixed Concrete - Poured Concrete with Buckets - Completed half of Foundation Pour	**Pouring Foundation** - Mixed Concrete with Small Mixer - Poured Concrete with Buckets - Finished second half of Foundation Pour	
			CMU Foundation - Mixed Mortar in Small Concrete Mixer - Laid 2 Courses of CMU Blocks Around Perimeter and Midspan	
				Compaction - Excavated Excess Dirt from Slab Area - Compacted Dirt to Level with 2 Courses of CMU Blocks
				Slab Preparation - Laid Waterproofing Membrane - Constructed Slab Reinforcing Bars - Set Formwork around Perimeter

Images at End of Day